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TITLE: COMPONENT ANTI-OXIDATION COATING FOR SUCH A COMPONENT AND CORRESPONDING PRODUCTION METHOD

TRANSLATOR'S DECLARATION

I, Walter F. Fasse, having an office at 60G Main Road North, P.O. Box 726, Hampden, Maine, 04444-0726, U.S.A.

solemnly declare:

that I am fully conversant and knowledgeable in the German language to fluently read, write, and speak it, I am also fully conversant and knowledgeable in the English language;

that I have, to the best of my ability, prepared the attached accurate, complete and literal translation of the German language text of:

PCT International Application PCT/DE2004/002194, as filed on October 4, 2004

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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ACCURATE LITERAL TRANSLATION OF PCT INTERNATIONAL APPLICATION PCT/DE2004/002194 AS FILED ON OCTOBER 4, 2004

Component Anti-Oxidation Coating for Such a Component and Corresponding Production Method

The invention relates to a component, especially a component of a gas turbine. Moreover, the invention relates to an oxidation protective or anti-oxidation coating for such a component, and a method for the production thereof.

The EP 0 784 104 B1 relates to a super-alloy on a nickel basis with optimized platinum-aluminum coating. Thus, this state of the art discloses an object with a platinum-aluminum surface region, whereby a substrate comprises a substrate composition on a nickel basis and a substrate surface, whereby first platinum and thereafter aluminum is diffused into the substrate surface, and whereby through these means a substrate region is prepared, which comprises an integrated aluminum content of 18 to 24 weight %, an integrated platinum content of 18 to 45 weight %, as well as a remainder with components of the substrate mass composition. The substrate region formed in this manner forms a protective layer for the substrate. According to the EP 0 784 104 B1, the integrated values of aluminum and platinum are determined by an integration method whereby the platinum content as well as the aluminum content is integrated over the spacing distance from the outer substrate surface. A lower integration limit lies at approximately 2 to 3 μm below the substrate surface. An upper integration limit is determined by the spacing

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distance from the substrate surface, at which the aluminum content measured in weight percent is reduced to a value of 18 weight % beginning from larger values. This upper integration limit is used both for the determination of the integrated aluminum proportion as well as for the determination of the integrated platinum proportion. In the sense of this state of the art, the preparation of the platinum-aluminum surface region is achieved through two successively performed diffusion processes. Through the separate aluminizing or alitizing, the production of such a surface region acting as a protective layer is time consuming and expensive.

Beginning from this, it is the underlying problem of the present invention to propose a novel component with a substrate region, a novel oxidation protective or anti-oxidation coating and a method for the production of such a component. This problem is solved in that the above mentioned component is further developed through the features of the characterizing part of the patent claim 1.

According to the invention, the component comprises a substrate composition on a nickel basis with an aluminum proportion of greater than 4.5 weight %. Exclusively at least one metal of the platinum group is diffused into the substrate surface of the component for the formation of the substrate surface region.

It is the underlying recognition of the present invention that a substrate surface region serving as an oxidation protection

of a component of which the substrate composition on a nickel basis or nickel alloy basis comprises an aluminum proportion of at least 4.5 weight %, can be produced in that exclusively at least one metal of the platinum group, preferably exclusively platinum, is diffused into the substrate surface of the component. Such a substrate region on the surface of the component has a good oxidation resistance or durability, and the same can be produced more economially than substrate regions known from the state of the art, in which a separate aluminizing or alitizing process is necessary after the in-diffusion of the platinum.

According to an advantageous further development or embodiment of the invention, exclusively platinum is diffused into the substrate surface of the component for the formation of the substrate region, whereby the integrated proportion of platinum (Pt) in the substrate region amounts to between 5 and 40 weight %, preferably between 5 and 30 weight %, and whereby the proportion of aluminum (Al) in the substrate region is determined by the substrate composition of the component.

Further independently protectable subject matters, such as an inventive coating and a method for the production of components are defined in the independent patent claims 11 and 19.

Preferred further developments or embodiments of the invention arise from the dependent claims and the following description.

Example embodiments of the invention are described in further detail in connection with the drawing, without being limited hereto. In the drawing:

Fig. 1 shows a component embodied according to the invention.

In the following, the present invention is described in greater detail with reference to Fig. 1. Fig. 1 shows a blade 10 of a gas turbine, namely an aircraft engine. The blade 10 has a blade proper or blade vane 11 as well as a blade root, base or pedestal 12. In the illustrated example embodiment, the entire blade 10, namely both the blade vane 11 as well as the blade base or pedestal 12, is coated in the region of a surface 13 of the blade 10 for the preparation of an oxidation protection.

The blade 10 forms a substrate for the coating for the formation of the oxidation protection on the surface 13 of the blade 10. The surface 13 of the substrate embodied as a blade 10 is thus also referred to as the substrate surface. The blade 10 has a mass composition or substrate composition on a nickel basis.

It is now in the sense of the present invention, to apply an oxidation protective coating onto a substrate with a substrate composition on a nickel basis with an aluminum proportion of greater than 4.5 weight %, in that exclusively at least one metal of the platinum group, preferably platinum and/or palladium, is diffused into the substrate surface. In the preferred example

embodiment, exclusively platinum is diffused into the substrate surface of the blade 10.

As already mentioned, the blade 10 has a substrate composition on a nickel basis with an aluminum proportion of greater than 4.5 weight %. The substrate composition on a nickel basis comprises an aluminum proportion of maximally 10 weight %.

In the preferred example embodiment, the platinum is diffused into the substrate surface 13 of the blade 10 in such a manner so that the integrated proportion of platinum in the platinum-aluminum substrate region being formed amounts to between 5 and 40 weight %, preferably between 5 and 30 weight %, and especially preferably between 5 and 17.99 weight %. The proportional content of aluminum and the remaining components is determined by the mass composition of the blade 10 or the substrate composition.

In the sense of the present invention it is thus proposed, to produce an oxidation protective coating for a component of a gas turbine with a substrate composition on a nickel basis, in that exclusively platinum and/or palladium, preferably exclusively platinum, is diffused into the substrate surface of the component. The aluminizing or alitizing process that is necessary according to the state of the art, can be completely omitted or avoided. A good oxidation resistance or durability can be produced.

The above mentioned platinum proportions in the substrate region are integrated proportions. The integrated proportions are determined through an integration method. In this integration method, an integration is carried out over the spacing distance d from the outer substrate surface, whereby the platinum proportion is dependent on the spacing distance or respectively on the depth relative to the outer substrate surface. In the sense of the present invention, the lower integration boundary or limit is formed either by the substrate surface itself or by a point directly below the substrate surface. In the case in which the lower integration boundary or limit is formed by the substrate surface itself, $x_{min} = 0\ \mu m$; in the case in which the lower integration boundary or limit is formed by a point directly below the substrate surface, x_{min} amounts to preferably 5 μm. An upper integration boundary or limit x_{max} is formed by the spacing distance or respectively by the depth relative to the substrate surface, at which the proportion of platinum has diminished to 5 weight % and remains under this value. The value of the integral is then still further divided by the difference between the upper integration limit x_{max} and the lower integration limit x_{min} so that then I_{Pt-int} pertains for the determination of the integrated platinum proportion:

$$I_{Pt-int} = \frac{1}{x_{max} - x_{min}} * \int_{x_{min}}^{x_{max}} I_{Pt}(x)dx$$

wherein:

I_{Pt-int}	=	integrated proportion of platinum
$I_{Pt}(x)$	=	proportion of platinum as a function of x
x	=	spacing distance or depth from the outer substrate surface
x_{min}	=	lower integration limit
x_{max}	=	upper integration limit

For the production of a component with such an oxidation protective or anti-oxidation layer, one proceeds such that in a first step a corresponding component with a substrate surface and a substrate composition is prepared or provided, whereby the substrate composition on a nickel basis comprises an aluminum proportion of at least 4.5 weight %. Then, exclusively at least one metal of the platinum group is diffused into a substrate surface of this component. In the sense of the invention, preferably platinum and/or palladium is diffused into the substrate surface, whereby the in-diffusion of exclusively platinum into the substrate surface is preferred. The in-diffusion of platinum is carried out in a drossing technique. In that regard, a corresponding platinum drossing material is applied onto the surface of the substrate and thereafter is aged or hardened.